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INTERIORITY - Architecture in the Future Prefabricated Home

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Published in:
Design Research Epistemologies 1

Publication date:
2010

Document Version
Early version, also known as pre-print

[Link to publication from Aalborg University](#)

Citation for published version (APA):
Frier, M. (2010). INTERIORITY - Architecture in the Future Prefabricated Home. In O. B. Jensen (Ed.), *Design Research Epistemologies 1 : Research in Architectural Design* (pp. 169-189). Departmental Working Paper Series, Dept. of Architecture, Design and Media Technology.

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10. INTERIORITY – Architecture in the Future Prefabricated Home

BY MARIE FRIER

- Timeline:** 01.10.2007 – 01.04.2011
(The PhD project has included a 6 months leave of absence in 2009, consisting in a full time project employment as Project Leader in a development project at Boel Living A/S as well as a 3 months research stay at TU Munich in 2008.)
- Keywords:** Domestic architecture, Prefabrication, Interiority, Architectural quality, Construction technique, Furniture, Joints.
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Poul Henning Kirkegaard, Department of Civil Engineering, Aalborg University
- Collaboration:** Boel Living A/S, Danish prefab-housing manufacturer based in Herning, Denmark.
- Biography:** Graduated in 2007 from the Department of Architecture & Design with specialization in Architecture at Aalborg University.

Project/chapter	Theory input	Methodology	Epistemology
<p>INTERIORITY</p> <p>– Architecture in the Future Prefabricated Home</p>	<p><i>Architectural theory,</i></p> <p>herein specifically aesthetics and interiority in relation to domestic architecture.</p> <p><i>Engineering science,</i></p> <p>herein specifically construction technology and management in relation to prefabrication.</p>	<p><i>Deductive theory development,</i></p> <p>herein literature studies and spatial analyses.</p> <p><i>Inductive prefab case study,</i></p> <p>herein field studies and 1:1 experiments within prefab practice at Boel Living A/S.</p>	<p>The project takes its point of departure in <i>phenomenology</i>, herein aiming to actively confront and develop subjective-aesthetic and objective-technical epistemologies mutually.</p>

Introduction

Within domestic architecture prefabrication has been envisioned as the means for improving not only the economy and technology, but also the architectural quality of the ordinary dwelling for over almost a century, a task which is still crucial in our continuously growing cities. This vision of establishing ‘the mass-production spirit’ as proposed by Le Corbusier as early as in 1919 was originally motivated by the challenges and opportunities posed by the industry and the intention to utilize technology in spatially establishing and hereby improving ‘the elements of the house on a mass production basis’ (Corbusier 2000 p.6). Thus, already in 1919 Le Corbusier expressed a need to unite technology and aesthetics; home and construction in order to improve the ordinary dwelling. However, throughout all these years this idea of uniting home and construction system through prefabrication has been a persistent challenge. Especially spatial detailing has been lost within the actual technical and economic practical realm of prefabrication, where constructive challenges concerning joints and tolerances have left the eventually produced houses as monotonous box-like constructions rather than inhabitable *homes* (Herbert 1984, Arieff, Burkhart 2003): Often these boxes are completely lacking particular spatial invitations such as the bath in Corbusier’s ‘Villa Savoye’ or the built in seats in Frank Lloyd Wright’s ‘Fallingwater’, spatial details which, it is my claim, signify the quality of these pioneering works as *homes*. Thus, even though today the belief in prefabrication seems to flourish again especially motivated by the development of novel CAD/CAM and rapid prototyping technologies, as recent publications such as (Arieff, Burkhart 2003, Anderson, Anderson 2007, Davies 2005, Kieran, Timberlake 2004) exemplify, there are still both spatial and constructive challenges to be overcome in order to reveal the potential of prefabrication as originally envisioned by Le Corbusier.

Not only has the general idea of shifting from traditional ‘bit by bit’ on-site construction to a systematic factory manufacture caused constructive challenges, today the booming development of novel digital technologies has increased these issues further as argued in (Hensel, Menges & Hight 2009). Thus, at a general level there seems to be a need to readdress the question of spatially defining *home*, and to let this particular issue be the point of departure for future constructive ventures in pursuing an improvement of the ordinary dwelling.

In this relation it is my initial hypothesis and particular point of departure for this PhD research, that the inhabitant’s spatial experience of *home* is dependent on specific interior details at the threshold of furniture such as the before mentioned built in bath in Corbusier’s ‘Villa Savoye’ described above; detailing which I here describe as *interiority*. It should be clearly stated that villas such as ‘Villa Savoye’ and ‘Fallingwater’ are unique and exclusive works of architecture built for specific clients and specific contexts, conditions which are radically different if not contradicting the ones characterizing the ordinary economically feasible prefabricated dwelling. However, it is my claim, that they contain crucial spatial principle necessary in pursuing a spatial definition of *home*. Thus, this PhD research takes its point of departure in an attempt to relate two extremities as within prefabrication practice, the revelation of such described unique details of *interiority* is significantly dependent on our constructive ability to economically and production-technically join building elements: There exist a gap between the sensuous qualities experienced in pioneering works such as the ‘Villa Savoye’ and the uninviting prefabricated constructions. Consequently the PhD project ‘*Interiorty – architecture in the prefabricated home*’ explores the potential for developing *interiorty* as a theory and design method for transforming constructive challenges within prefabrication practice into sensuous spatial qualities in the future prefabricated *home*. Thus, at a general

level the project is concerned with the subject of architectural quality, the question of spatially defining *home*, a subject within which prefabrication (in a Nordic context) forms a particular practical case-study. The project is being developed in cooperation with the Danish housing manufacturer, Boel Living A/S, and this cooperation, in particular, is the starting point for attempting to combine theory development with actual practical achievements, guided by the following general research question.

What are the sensuous qualities spatially defining home, and how to formulate a theory and design method for actually revealing these qualities in an improvement of the architectural quality of the prefabricated house in practice?

In continuation hereof the goal of the research is twofold; intended in part to develop a theory and design method for improving the architectural quality of the prefabricated house, and in part to achieve actual practical results at Boel Living in an attempted testing/application of the developed theory. This twofold theoretical and practical goal set has been the starting point for attempting to methodologically interrelate theory and practice. In this contribution to our publication on 'Research Epistemologies' I have chosen to focus specifically in this methodological duality of my PhD research and used it as an opportunity to discuss the nature of architectural research in general.

Methodology

Architecture is a multidisciplinary field requiring the skills to comprehend and to balance objective-technical as well as subjective-aesthetic aspects in order to realize spatial ideas within a specific social and physical context as formulated originally by Vitruvius (Vitruvius 1960). As stated by the sociologist Linn Mo in her writings concerning 'Theories of Science for Architects' as well as by Linda Groat and David Wang in their 'Architectural Research Methods', this inherent multidisciplinary of architecture is reflected within architectural research, where multiple epistemologies are often needed in the approaching of a particular problem, but with no actual recipe for how to make it all work together (Mo 2003, Groat, Wang 2002). Thus, when seen in relation to the particular dual spatial and technological challenges of the prefabricated *home* described above, the questions is how to organize these different modes of reasoning?

Being a highly technically skilled architect but also a painter and a writer, Le Corbusier took this particular question as his point of departure. Le Corbusier tenaciously insisted on attempting to describe the complexity of architectural reasoning as well as its practical implications throughout his career, which makes his theories crucial as a point of departure here. In stating that '*eventually only passion can create drama out of inert stone*', Corbusier clearly put the main focus on the intangible subjective aspects of architecture in his writings, herein defining architectural knowledge as a complex interrelation of hand and mind, necessarily dependent on a strong aesthetic intention (Corbusier 2000 p. 4). Following this line of thought, the experienced quality of a particular work of architecture eventually springs from our individual interior understanding of space, but what does this mean in a research context?

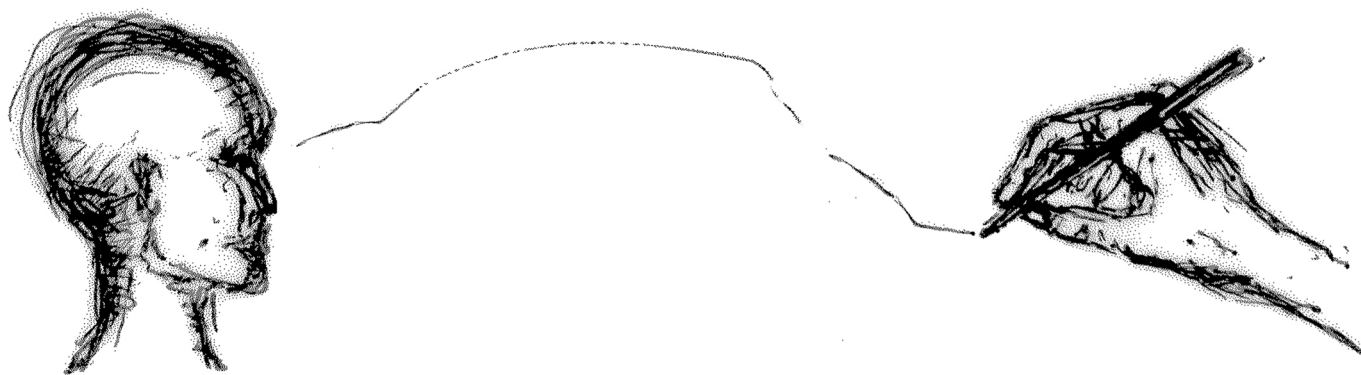


Fig. 1: Architectural reasoning: a complex and inherently opaque interrelation of mind and hand.

Research, is first and foremost a systematic and transparent inquiry, requiring that the hypothesis tested must be verifiable (or falsifiable) within an exterior context as described by Bruce Archer in his ‘The Nature of Research’ and by Lars-Henrik Schmidt in his ‘The Scientific Perspective’ as well as by many others (Archer 1995, Schmidt 2001). Thus, in research we need to be able to transmit our knowledge, to describe the steps taken to reach the presented conclusions, a condition which does not immediately correspond to Corbusier’s opaque definition of architectural knowledge. Symptomatically, as architects attempting to do research we often refuse the necessary systematic and transparency required, limiting our interest to the historical and narrative aspects of architecture as argued by Christopher Frayling

(Frayling 1993). In continuation hereof Frayling already in 1993 made the statement, that it is not until we get used to the idea that we don’t need to be scared of ‘research’, or in some strange way protected from it’, that we can as architects begin to approach this dilemma (Frayling 1993. p. 5). However, it is my claim, that there are also examples of how such a statement can lead to an uncritical commitment to these scientific principles, and in doing so, to a neglect of the fact that we are actually passionate architects, as pointed out so clearly by Corbusier, dependent on an aesthetic dimension to our inquiries. Within the context of prefabrication for example a tremendous amount of research is being done into the constructive, organizational and production technical aspects within theoretical fields such as lean construction,

however often completely omitting to relate these studies to any declared aesthetic architectural goals as argued in (Frier, Kirkegaard & Fisker 2008). Thus, both in an attempt to conduct research within architecture and in the general architectural practice it is necessary to ask whether it is possible to develop a research methodology which takes its point of departure in developing and visualizing the interior 'passion' described by Corbusier: But in doing so, to take a closer look at how scientists make their inquiries transmittable, rather than trying to distance ourselves from them. In continuation hereof I look at architectural research in general and PhD research in particular as an opportunity to reflect upon the nature of architectural reasoning as well as our role as architect and as researchers, or one might say as architect-researchers. In this matter I have chosen to use Charles Sanders Peirces' philosophical writings as a point of departure. Peirce was a physicist and a mathematician but also developed an interest in philosophy, pragmatism and semiotics, which makes his particular theories a obvious point of departure in attempting to combine rather than chose between subjective-aesthetic and mere objective-technical epistemologies.

The circle of inquiry

Inspired by early concepts from Aristotle, Peirce defined three basic modes of reasoning; abductive, deductive and inductive inference, together forming a 'circle of inquiry' (Peirce op. 1998-. p. 267-288). Herein Peirce defined abduction as the formulation of a hypothesis developed from a subjective, but specific *idea*, directing the following deductive process. Here a general theory clarifying the relevant consequences of the hypothesis is to be formulated and developed, which is finally documented through an inductive testing of the theory within a specific context. Thus, according to Peirce, neither abduction nor deduction or induction make sense in isolation from each other but comprise a cycle, herein implying that research in general is dependent on our individual creativity: *'Deduction produces from the conclusion of Abduction predictions as to what would be found true in experience in case that conclusion were realized. Now comes the work of Induction, which is not to be done while lolling in an easy chair, since it consists in actually going to work and making the experiments, thence going on to settle a general conclusion as to how far the hypothesis hold good'* (Peirce op. 1998-. p. 288).

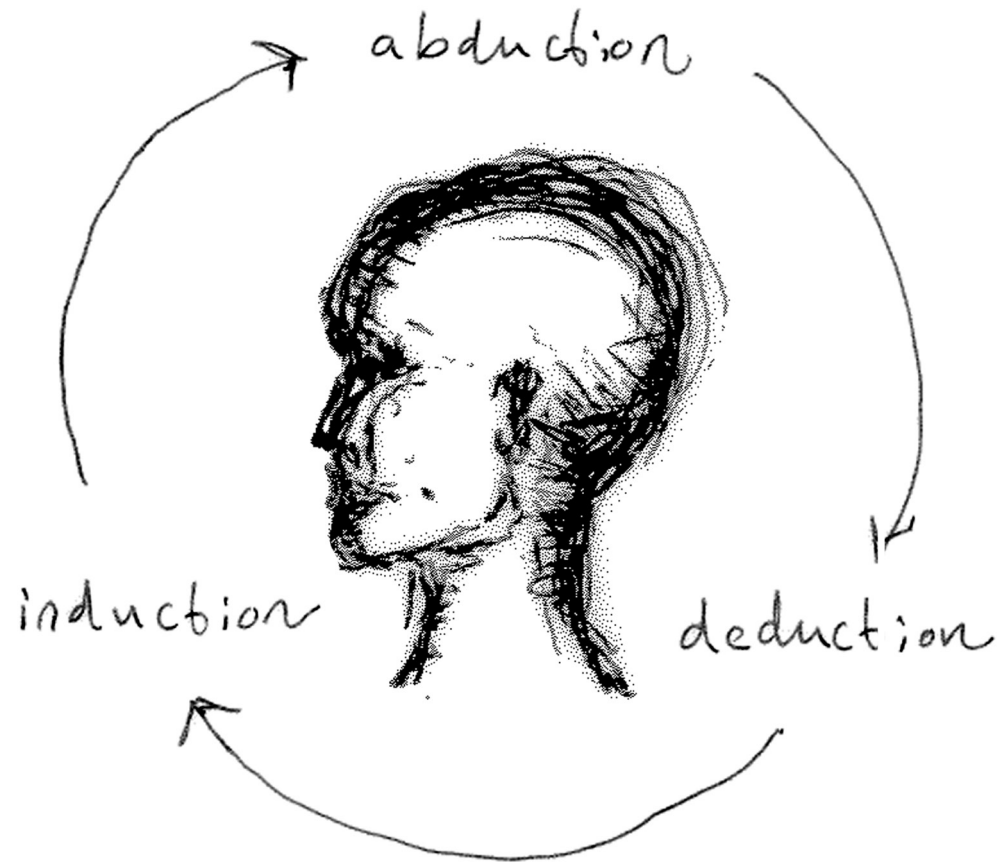


Fig. 2: Graphical representation of the circle of Inquiry inspired by Peirce's theories.

Following this line of thought one could say that mind and hand, subjective passions and objective techniques are connected, even in research within the sciences, and that this connection is necessary in order to eventually transmit the developed knowledge. However, whereas for the mathematician, deduction of a theoretical proof of his initial, and in parallel to Corbusier's theories, passionate idea and following inductive documentation of the proof can be done continuously at the blackboard, for the architect, documentation can hardly be done on paper. One could say that within architectural research theory and practice are necessarily interrelated. Thus, in the case of architecture the quality of a particular space cannot be defined using a general positive rule, it is context-dependent, and in order to understand its qualities we have to experience it; to sense its qualities as a phenomenon. As argued for by architectural theoreticians such as Gaston Bachelard, Juhani Pallasmaa and Christian Norberg-Schulz this means that as architects we need to understand the phenomenology of architecture, herein the multi-sensuous qualities, and dual physical and metaphysical meaning of dwelling, related to the actual built up of architectural space (Bachelard 1994, Pallasmaa 1996, Norberg-Schulz 1985). Thus, in the construction of a house as a phenomenon, it is our 'virtue' as architects to imagine ourselves being its future user, endeavoring to transcend qualities which we hope that the user will experience and appreciate. Consequently, appreciation of a particular space is the result of a kind of dialogue between architect and user mediated via the shaping of the space itself, thus, it is in the experience of the architectural object that the evidence of its underlying theory is to be found. As architects one could say that this is how our theories are eventually proven, but what does this mean with regards to our particular concern for research methodology in general here?

According to Peirce a phenomenon can be endeavored described as consisting in three elements; a referent object,

a message, and the persons reading of this message (Peirce op. 1998-). As argued by Lars Brodersen, Peirce herein introduces a classification of the contents of a phenomenon, constituting a system for how to understand phenomena as a methodological transmission of knowledge from firstnesses (potentials, qualities, feelings, ideas) to thirdnesses (relations, rules, theories) to secondnesses (actual instances, action, will) (Brodersen 2007. 179-184). This transformation of ideas into general theories to be applied in specific actions, elaborating upon his circle of inquiry, can simultaneously be looked upon as creation of knowledge or simply; research. Consequently Peirce eventually defines research as communication processes, consisting in individual aesthetic considerations (ideas) motivating the development of general techniques (theories) and the documentation for these theories unfolded in the practical application (Peirce op. 1992-). Thus, in the case of architectural research, Peirce's circle of inquiry methodologically inscribes idea, theory development and practical documentation in a necessary interrelation allowing for transmission of knowledge via communication and hereby development. With the recognition of this affinity of mathematical and architectural reasoning, Peirce's circle of inquiry offers a general methodology for how to make the passionate aesthetic intentions described by Corbusier, the point of departure for research in general. However, this not in accept of the strictly positivist rationale usually associated with mathematics, but as a way of relating the necessary subjectivity of the *idea* with the objective system of reasoning through a deliberate connection of the subjective-aesthetic and mere objective-technical aspects defining architecture. Rather than solely producing works of architecture as it is the task of the architect, the architect-researcher must necessarily reflect upon the architectural work, herein attempting to inscribe it in a wider context. This reflective element moving from idea, to theory, to practical application, to idea etc. can be looked upon as an integrated

and necessary part of architectural practice assuring development and innovation, thus, ideally including research. However, often reflection is pushed in the background within the economy and time pressure of the practical realm, leaving the works as insignificant ‘copies’ or successes created by the ‘luck of chance’. Thus, as architect-researchers I find it our responsibility to engage in this reflection, but also it must be stated, to relate our research to practice in order to make it relevant and eventually applicable.

Thus, with Peirce’s circle of inquiry interrelating architectural theory and practice through research as a starting point, I can hereby return to the formulated initial hypothesis and following research question constituting the abductive level of this PhD research; the specific *idea* that architectural quality is identified and appreciated via impressions of *interiory*. In continuing onto the deductive and inductive levels the PhD project can hereby be divided into two interrelated halves;

- ***Deductive theory development*** (serving the purpose of developing the proposed concept of *interiory* as an architectural theory and design method)

and

- ***Inductive prefab case study*** (serving the purpose of attempting a test/application of the developed interior architectural theory in actual confrontation with prefab practice at Boel Living)

The question is, however, what is implied within the notion of ‘deducing’ an applicable and verifiable architectural theory, how do we actually approach this matter?

As argued by Linn Mo architectural theories are seldom written with the intention of test and critique, rather they are based merely on lifelong experiences with the field, maybe even based on an experience as a critic rather than as a practicing architect (Mo 2003). These theoretical works, such as Bachelard’s ‘Poetics of Space’, Norberg-Schulz’s ‘The Concept of Dwelling’ and Pallasmaa’s ‘The Eyes of the Skin’ are main sources and stepping stones which cannot be neglected as an important point of departure for further research (Bachelard 1994, Pallasmaa 1996, Norberg-Schulz 1985). However, as Mo claims such historically oriented studies often take the shape of descriptions and personal experiences, whereas in its essence research is forward-minded requiring of the theories developed to be applicable (Mo 2003). Following this line of thought, also paralleled in Peirce’s circle of inquiry, what we are after here is the development of a theory applicable in a specific context, namely that of prefabrication. In continuation of the above, an architectural theory must on the one hand be sparked by personal experiences and perception as are the works of Bachelard, Norberg-Schulz and Pallasmaa, but on the other hand simultaneously enable an articulation and relevant application of these experiences and ideas: In following the line of thought of Corbusier, one could say that the most important task in making a work of architecture, and hereby also an architectural theory relevant and applicable is to be able to clarify its idea, in case of this particular PhD research the notion of *interiory*. In the following I will go into the particular theoretical frame of the project in this specific matter.

Theoretical frame

Prefabrication

For over a century prefabrication has been envisioned as a means of lowering costs and improving quality through fast, precise and effective production. Especially within the context of domestic architecture the idea, or as formulated by Gilbert Herbert, ‘*the dream*’ of the factory made house, has been inextricably linked with the intention to meet the still increasing and global need for architectural improvement and cost-efficiency of the ordinary dwelling (Herbert 1984). However, whereas the ‘dream of the factory-made house’ originally formulated by Modernist pioneers such as Le Corbusier, spread, as described by Gilbert Herbert and later by Colin Davies, the task of formulating actual design principles capable of fostering a practical revelation of this dream has proved to be a challenging matter (Herbert 1984, Davies 2005). As described in Herbert’s analysis of the works of the two Modernist architects Walter Gropius and Konrad Wachsmann and in Arieff & Burkhardt’s more recent prefab study, the necessary sensuous spatial qualities of *home* are here often lost within the technicality of construction as a system (Herbert 1984, Arieff, Burkhardt 2003). Wachsmann’s early search for the ‘perfect joint’ is

just one example of such technical ventures which never led to any spatial results. Actually the transformation of traditional onsite ‘bit by bit’ construction into high precision factory assembly in itself has often caused joint and tolerance challenges making prefabrication as expensive as traditional construction as studied in (Frier, Kirkegaard & Fisker 2008 p.533–540). As a consequence the houses which have actually reached production are often experienced as monotonous box-like constructions rather than sensuous inhabitable *homes*, often produced completely without the involvement of architects (Arieff, Burkhardt 2003 p.9–10). The illustration below shows a principle sketch of typical plan solutions for a contemporary Danish prefabricated house and how the prefabricated elements, here complete ‘boxes’ fitted for onsite installation often become decisive in terms of the interior organization of the house. Here partition walls unconsciously follow the modular lines of the rigid prefab ‘boxes’, making the individual rooms of similar proportions and hereby also similar spatial qualities; the bedroom looks like the kids room, which looks like the bathroom, which looks and like the study, none of which are sensuously inviting. Thus, when held together with Corbusier’s initial vision the challenge of the prefabricated house seems to be still both constructive and spatial.

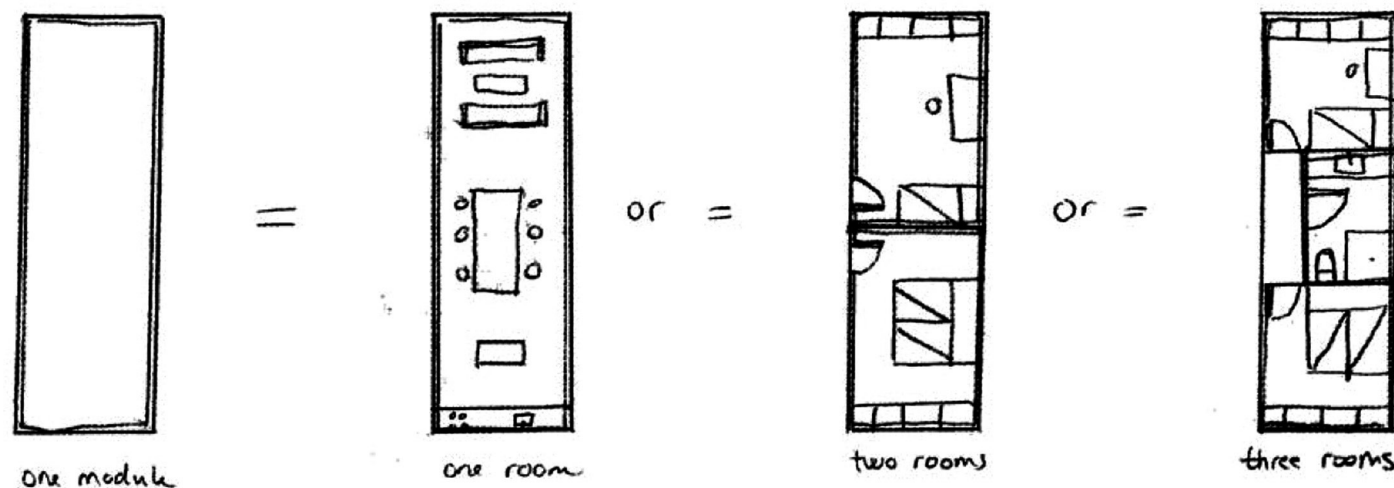


Figure 3. Sketch of typical prefab plan-solutions.

To Corbusier, the revelation of the ‘*mass-production spirit*’ was not solely a technical and constructive practical issue as it has often become in practice, but also a sensuous spatial matter. In stating that the mass produced house should be beautiful not only in the ‘*way that the working tools and instruments which accompany our existence are beautiful*’ but also ‘*with all the animation that the artist’s sensibility can add to severe and pure functioning elements*’ this position is evident (Corbusier 2000 p.7). Herein Corbusier aspired to the less tangible but, it is our claim, vital sensuous spatial qualities of *home*. However, whereas this envisioned sensitivity can be experienced in the intimacy of the interior detailing of for example the bath in Corbusier’s ‘Villa Savoye’ or the built in seats and

bookshelves of Frank Lloyd Wright’s ‘Fallingwater’ these works were, as many other works of the Modernist pioneers, out of constructive reach of prefab practice and hereby also out of economic reach of the general public as described in the introduction. Thus at a general level there seems to be a gap between the experiential aesthetic knowledge about the spatial principles signifying *home* inherent within the works of architects like Corbusier and Wright and the actual practical prefab ventures realized. This particular gap between *home* and construction caused by the complex economic and technical implication of prefab practice is also reflected within research, where focus is often on either space or construction, seldom their interrelation. As an example a

lot of research is being done by engineers within the technical and organizational aspects of prefabrication related to theory fields such as Lean Construction without the involvement of architects or aesthetic parameters as argued in (Frier, Kirkegaard & Fisker 2008). Likewise architects and historians are concerned with research within architectural theory and aesthetics however seldom directly related to specific practical contexts such as Gaston Bachelard's monograph on 'The Poetics of Space' and many others (Bachelard 1994). Thus, at a general level the success of future prefab endeavors seems to be dependent on our ability as architects to engage with the practical and economical realm of prefabrication attempting to transform the before mentioned constructive challenges into sensuous spatial qualities, integrating space and construction through research: A unique potential in which a readdressing and visualization of the sensuous spatial qualities of *interiority*, signifying the works of pioneering architects such as Corbusier and Wright, are a necessary point of departure in pursuing a thorough spatial understanding of 'the elements of the house' to use the word of Corbusier himself. This is where this particular PhD research takes its point of departure. As described in the introduction it is my initial hypothesis that the inhabitant's experience of *home* is dependent spatially on sensuous impressions of *interiority*, detailing at the threshold of furniture, herein implying that sensuous spatial detailing such as a built in mezzanine or a sky lit shower are crucial elements in our recognition of a particular space as *home*. The question is however, how to progress from this initial intuitive hypothesis to the pursued development of an actual applicable theory.

Interiority

If considering our sensuous perception of space we intuitively recognize the cruciality of Mario Praz's notion, that in its capacity as a molded gesture to the human body, the softness of interior furnishing preconditions our experience of a place as *home*: A soft *interiority* without which '*the human soul would feel like a snail without its shell*', and which it is our claim, can be rediscovered as a spatial discipline interrelating that of architecture and furniture making in the precisely orchestrated interiors of for example Mackintosh, Loos, Corbusier, Wright, Schindler, Aalto and Fehn (Praz 1964). In the sensuousness of these interiors, we perceive how room and furniture merge as a result of a deliberate engagement with functionality and scenography in the transformation of the architectural volume into a *home*.

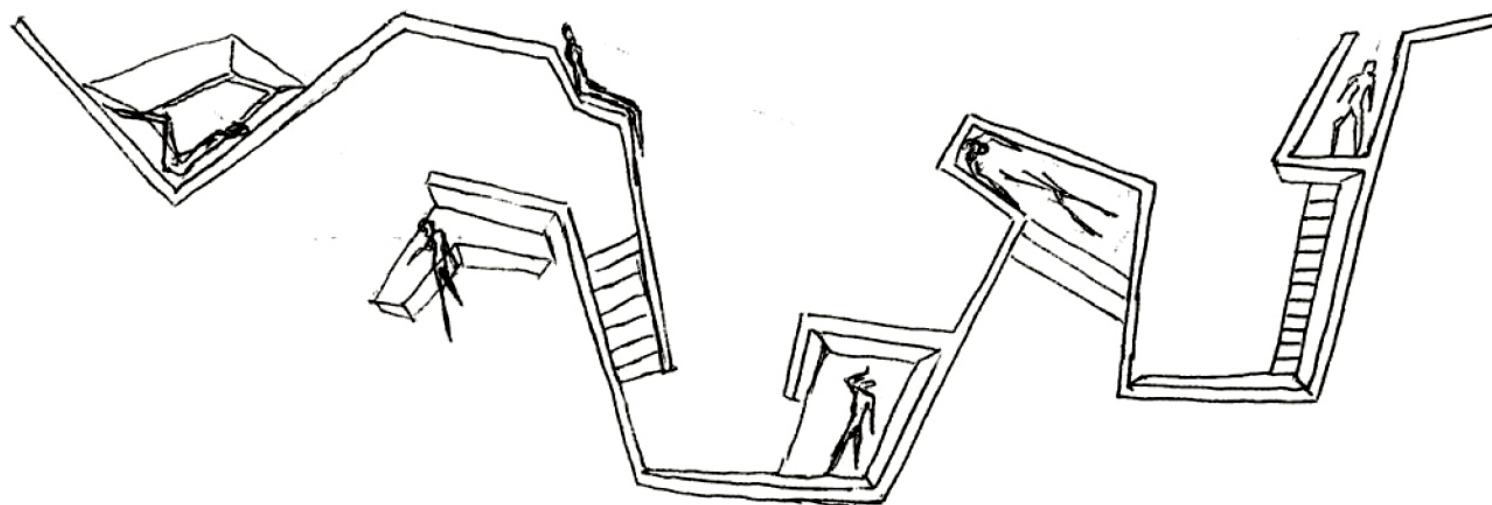


Figure 4. Interiority; sensuous spatial invitations to sit, cook, bathe, sleep etc.

Thus, when utilizing the term *interiority* in an initial attempt to approach a spatial definition of *home*, I herein suggest a necessary venture into a boundary field interrelating that of architecture and furniture. This suggestion of an architectural approaching of the human body akin to that of furniture is rooted in interior architecture as a discipline and a 'virtue'. With its origin in the Bourgeois interior of the nineteenth century as studied by Charles Rice, the interior has emerged not only as a practical discipline but also as a research field (Rice 2007). As described by Charles Rice, the term *interiority* initially described inner subjectivity; however, later it became related also to the interior of a physical space, herein the sensuous aspects of furnishing, as studied

by Mario Praz, Anne Massey and John Pile among others (Praz 1964, Rice 2007, Massey 2001, Pile 2009). Besides ongoing publication of now three refereed journals counting *Journal of Interior Design* established in 1993, the *IDEA Journal* published since 2001, and the brand new *Interiors: Design, Architecture and Culture* a number of researchers have published individual monographs as well as edited anthologies on the sensuous, spatial, historical and cultural aspects of the interior and *interiority* as a field. Charles Rice's 'The Emergence of the Interior', John Kurtich and Garret Eakin's 'Interior Architecture' and Mark Taylor and Julieanna Preston's 'INTIMUS: Interior Design Theory Reader' are examples hereof (Rice 2007, Kurtich, Eakin 1993, Taylor,

Preston 2006). However, when related to the above outline of the challenges of prefabrication the revelation of this sensuous potential of the interior becomes significantly dependent on our constructive ability to economically and production-technically join building elements. Thus, in this PhD research I am specifically pursuing a linking of *interiority*, as a sensuous and spatial aesthetic approach to the *home* with a practical and constructive understanding of the technical conditions characterizing prefab practice; an applicable theoretical integration of space and construction. In continuation hereof I can now begin to outline the particular strategy for approaching the actual research, herein the structuring of the deductive theory development as well as the inductive experiments at Boel Living A/S.

Research strategy

As implied in the sketching of Peirce's 'circle of inquiry' the research process cannot be looked upon as a strict linear process, rather as a series of loops jumping from hypothesis to theory development to test/application of the developed theory leading to a refinement of the initial hypothesis initiating a new loop. However, in using Peirce's circle of inquiry as a general methodology in relation to his phenomenological understanding of research as a progression from ideas to theories and to actions, a structuring principle for how to organize these loops can be developed (Brodersen 2007). The figure below shows how the two interrelated parts defining the PhD research, can be structured using this general model.

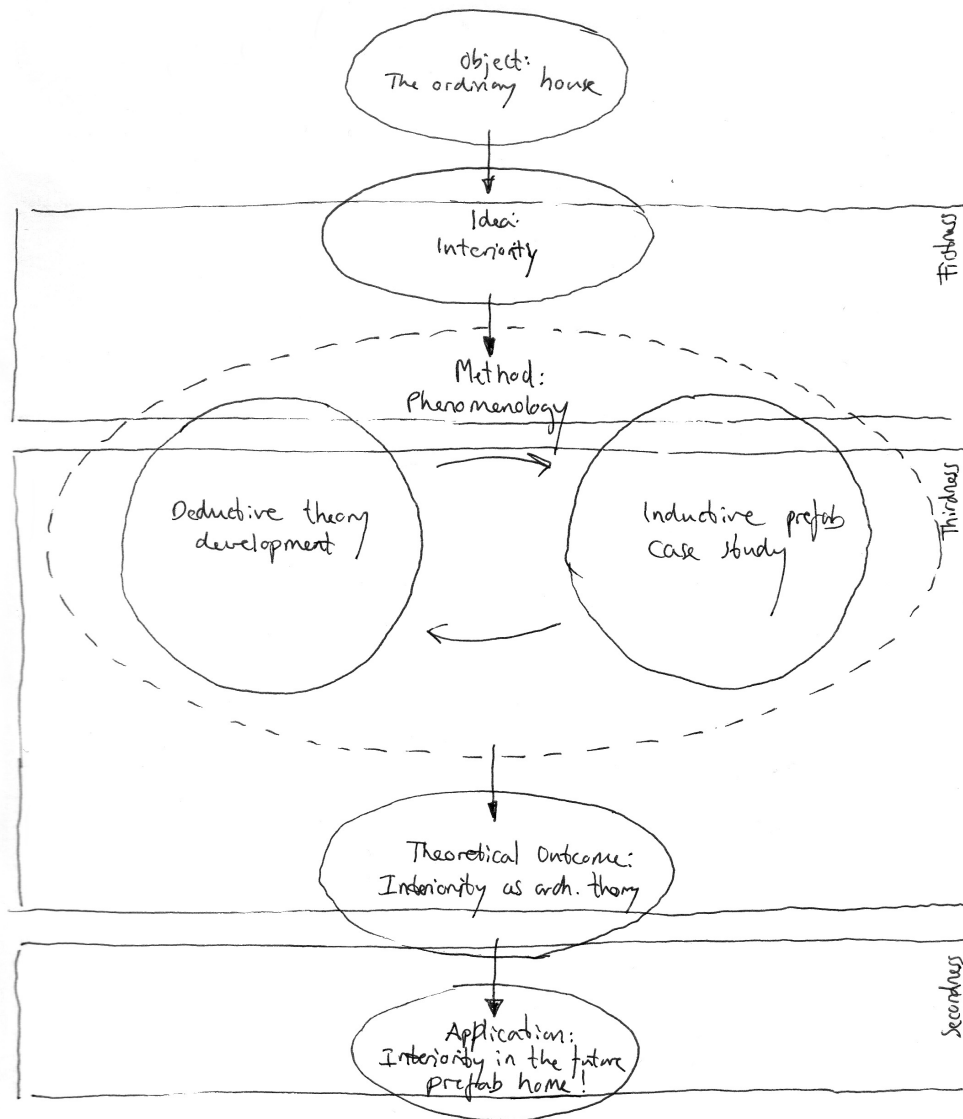


Figure 5. Project structure, inspired by Lars Brodersen's reading of Peirce's phenomenology (Brodersen 2007).

Motivated by the observations made above in reviewing the theoretical frames of prefabrication and *interiority* respectively, the figure also shows the specific research strategies chosen in the deductive theory development and the inductive prefabrication experiments respectively. Below I will briefly argue for these choices as a point of departure for discussing the preliminary and intended future outcome of the research. Whereas the research necessarily consists in several 'loops' the below description is, however, more linear in character in an attempt to clarify the process. Finally I will conclude with a few remarks concerning the sort of knowledge contributed by the research; its theory of science.

The proposed deductive theory development:

In continuation of the initial hypothesis and the theory review above the proposed deductive theory development takes its point of departure in *interiority* and a development of this concept as an architectural theory. As described, this idea of *interiority* was motivated by the observation that there is a need to readdress the spatial elements of *home*; the fact that there exists a gap between the sensuous qualities experienced in the pioneering works of architects such as Corbusier, Mackintosh, Wright, Schindler, Aalto, Fehn etc. and the uninviting constructions of the ordinary prefabricated house. In continuation hereof this part of the research project takes its particular point of departure in a revisiting of these works, in a search for general architectural 'virtues' and principles for how these perceived qualities can be activated in a future positioning of *interiority* as a theory and methodology for transforming construction into *home*. Herein the mentioned works are analyzed using *interiority* as an analysis method, pursuing a visualization and actualization of their underlying spatial principles.

This search for spatial principles of *home* is combined with a more general hermeneutic study of *interiority* in relation to domesticity, and with studies into the technical

origin of architecture as a means for pursuing a theoretical linking of these principles with the actual constructive and economical practical realm. In this matter Gottfried Semper's theories on the origins of construction as a soft wrapping of the human body and Werner Blaser's more direct linking of architecture and furniture focusing on the joint, are main sources, in attempting to establish this link (Semper 2004, Semper 1989, Blaser 1985, Blaser 1984, Blaser, von Büren 1992). As a preliminary outcome these studies have resulted in a particular focus on the actual physical linking of the constructive joint with the intended sensuous and scenographic ability of furniture, initially described in (Frier, Fisker & Kirkegaard 2008) and more thoroughly developed in a paper accepted for publication in connection with the upcoming international 'Architecture and Structures' conference in Portugal 2010. With this linking of the sensuous spatial principles of *home* with the economy and geometry of the constructive joint there is a potential to progress from a hypothetical idea to an actual application of *interiority* as a theory and an actual design method for physically transforming the joints, the problem areas of construction, into sensuous furnishing qualities within the realm of prefabrication practice. Thus physically looking at the technical elements of construction; plate, shear wall, beam, column, bolt and screw as possible furnishing details; places in which to sit, eat, sleep, bathe and synthesize.

The proposed inductive prefabrication case-study:

With regards to the proposed prefabrication case study, this part of the research takes its point of departure in an attempt to document the developed theory through test/application within the actual practical realm at Boel Living A/S. However, in order to provide a basis for this attempted test and application a thorough study of the practical context of prefabrication is needed. Thus, in continuation of the above theory review concerning prefabrication these studies are based in a hermeneutic study of the history of prefabrication

and of the current development within this field as well as within construction and material technology in general, studies in which Gilbert Herbert, Colin Davies and Stephen Kieran & James Timberlake's writings are main sources (Herbert 1984, Davies 2005, Kieran, Timberlake 2004). These studies are combined with actual field studies at Boel Living, studies which are concerned with prefabrication as a constructive system as well as the organizational aspects of factory production and management. As a general strategy these field studies involve actual participation and involvement in the production at Boel Living, and have shown that at a general level prefabrication differs from traditional 'bit by bit' construction in being dependent on a geometrical approach securing a fast and precise production and assembly process. Seen in relation to the pursued improvement of the sensuous spatial detailing of the monotonous box-like prefabricated house, these qualities must be developed directly within the geometry and economy of the actual construction system, paralleling the theory and design method developed in the theoretical part of the project. Consequently, there are two main (and interrelated) tasks to be overcome in order to achieve this goal; one is to improve the overall constructive geometry and economy of prefabrication as a system, the other is to progress from this general system to an actual sensuous and spatial exploitation hereof in establishing the 'elements of the house' on a production basis, to use the words of Corbusier. At present stage these observations have been activated as means in the development of a novel lightweight sandwich construction system at the factory, described in the paper 'Prefab-Interiority' which is currently being printed in the international journal 'Design Principles and Practices'.

In this relation, the motivation for pursuing a novel construction system and housing series has been to develop a system 'born' within the factory, where the many layers of the traditional wood frame construction hitherto used at

Boel Living can be reduced in a tight and easily assembled envelope. These criteria have led to the development of a simple cast lightweight sandwich element with thin high-strength concrete cover layers and high insulating EPS core material, an element suitable for wall, floor and ceiling elements alike, constituting an entire building envelope (Troelsen, Frier & Troelsen 2009). This construction system holds a number of potentials particularly in relation to energy-efficiency and sustainability in general due to its simplicity of production, material use, insulation properties and tightness and is currently undergoing further testing and patenting. At the level of actually progressing from this general system to an actual sensuous and spatial exploitation hereof this is, however, a challenge which will necessarily require extensive future studies and experiments to solve. At present stage these studies have led to the idea of developing a 'connector', as a kind of intermediate mechanism capable of adopting tolerances and assuring a tight module joint between the box-line elements. Thus attempting a practical revelation of the developed theory and design method for transforming the technical elements of construction; plate, shear wall, beam, column, bolt and screw as possible furnishing details of *interiority*. This idea has still only reached a conceptual level; however, from a spatial point of view it holds potentials for future development, which I am eager to pursue.

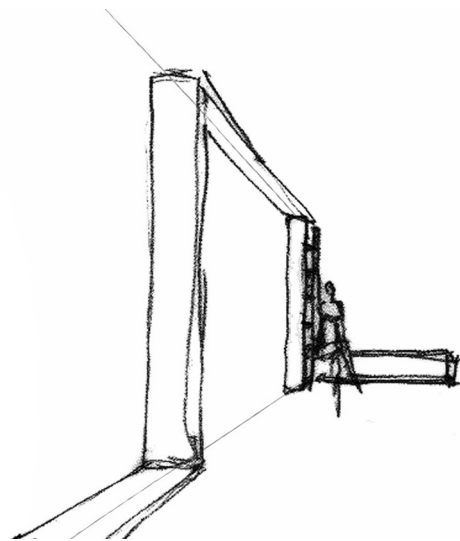


Figure 6. The 'connector' as an intermediate furnishing space-creating joint mechanism.

Theories of Science

In continuation of the general methodology developed with the specific aim to combine rather than chose between the subjective-aesthetic and objective-technical epistemologies constituting the architectural field, the knowledge intended to result from the PhD research is likewise twofold. As put forth in the introduction the research question and consequent research goals are in part to develop a theory and design method for improving the architectural quality of the prefabricated house and in part to achieve actual practical results at Boel Living in an attempted testing/application of the developed theory. The question is, however, if it is at all possible to speak of an applicable architectural theory?

Within a multidisciplinary field such as architecture it is a precondition for application and recognition of our research, beyond our own specialized aesthetic interest in space, that we enter a dialogue with the many fields engaged with architecture; sociology, engineering, production management etc. However, when recalling Corbusier's notion that 'only passion can create drama out of inert stone' meaning that architectural knowledge is in its essence preconditioned by individual ideas and intentions, the concept of an architectural theory within a transmittable research system seems contradictory. When held together with Peirce's general phenomenological definition of research as being dependent on communication processes a linking of subject and object, however, emerges. Within architecture it is precisely the 'drama' and 'passion' described by Corbusier, and experienced in for example his 'Villa Savoye' bath which catches interest and 'speaks' to the inhabitant, a communication actually equaling Peirce's research definition presented above. If following this line of thought it is eventually our sensuous experience of such *interiorities*, detailing at the threshold of architecture and furniture, which has the potential to trigger interest, appreciation, wonder and eventually new ideas, experiences which are individual but in a sense also common human. As opposed to terms such as hierarchy, symmetry, order etc. often utilized in describing architecture and its theory, furniture and *interiority* are immediate matters. Whether being architect, future inhabitant, engineer, worker, salesman or manager we all recognize the quality of for example an embracing window seat, letting us sense *home*. Thus, making these experiences the point of departure for research hereby also forms as particular potential for visualizing and activating these architectural 'virtues' within a systematic and transmittable development process; a potential and a responsibility of the architect-researcher. Especially within the complex constructive, economical and organizational practical realm of

prefabrication, there is a need for theories and design methods for placing these *'interiorities'* at the center of discussion and of production. It is this particular challenge and unique potential which motivates my research.

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